

## CLAIMS

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1. A system for determining in vivo conditions, the system comprising:
- at least one interaction chamber for containing an in vivo sample, said interaction chamber having at least one indicator therein for reacting with the in vivo sample for generating optical changes in the interaction chamber;
- at least one illumination source for illuminating the interaction chamber;
- and
- at least one optical detector for detecting optical changes occurring in the interaction chamber.
2. A system according to claim 1 wherein at least a portion of the interaction chamber is transparent in the wavelength of illumination.
3. A system according to claim 1 comprising a plurality of interaction chambers.
4. A system according to claim 1 further comprising a micro pump for drawing the in vivo sample.
5. A system according to claim 3 wherein one interaction chamber comprises one indicator and another interaction chamber comprises another indicator.
6. A system according to claim 1 wherein the interaction chamber is sealed by at least one membrane which selectively enables passage of an in vivo sample but does not enable passage of the indicator.
7. A system according to claim 1 wherein the indicator is immobilized onto the interaction chamber walls.
8. A system according to claim 1 wherein the indicator is immobilized onto an appendage that is restricted to the interaction chamber.

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9. A system according to claim 1 wherein the optical detector is an imager for obtaining images of the interaction chamber.
10. A system according to claim 9 further comprising a transmitter for transmitting the images.
- 5 11. The system according to claim 10 further comprising a receiving system for receiving the images.
12. A system according to claim 1 wherein the optical detector is an imager for obtaining images of a body lumen and of the interaction chamber.
13. A system according to claim 1 wherein the optical detector is an imager for obtaining  
10 images of a body lumen and of the interaction chamber and for producing video signals thereof.
14. A system according to claim 13 further comprising a transmitter for transmitting the video signals and a receiving system for receiving said video signals.
15. A system according to claim 1 wherein the system is contained within or affixed onto  
15 a device that is designed for being inserted into a body lumen.
16. A system according to claim 9 wherein the system is contained within or affixed onto a device designed for being inserted into a body lumen.
17. A system according to claim 12 wherein the system is contained within or affixed onto a device designed for being inserted into a body lumen.
- 20 18. A system according to claim 12 further comprising an optical system.
19. A system for determining in vivo conditions, the system having at least two opposing ends and comprising:

two interaction chambers for containing an in vivo sample, said interaction chambers each having at least one indicator therein for reacting with the in vivo sample for generating optical changes in the interaction chamber;

at least one illumination source for illuminating the interaction chamber;

and

two image sensors for detecting optical changes occurring in the interaction chamber and for obtaining in vivo images,

wherein the interaction chambers and the imagers are each positioned at an opposing end of the system.

20. The system according to claim 1 further comprising a battery for providing power to elements of the system.

21. A system for determining in situ body lumen conditions comprising

at least one interaction chamber for containing an endo-luminal sample, said interaction chamber comprising at least one indicator for reacting with the endo - luminal sample for generating optical changes in the interaction chamber;

at least one illumination source for illuminating the body lumen and the interaction chamber;

at least one imager for imaging the body lumen and for imaging the interaction chamber.

22. A device for determining in vivo GI tract conditions, comprising:

at least one interaction chamber for containing a sample from the GI tract environment, said interaction chamber comprising at least one indicator for reacting with the sample for generating optical changes in the interaction chamber;

at least one illumination source for illuminating the interaction chamber;

10046540-011602

at least one optical detector for detecting in vivo optical changes occurring in the interaction chamber.

23. A device for imaging the GI tract and for determining in vivo GI tract conditions, comprising

5 at least one interaction chamber for containing a sample from the GI tract environment, said interaction chamber comprising at least one indicator for reacting with the sample for generating optical changes in the interaction chamber;

10 at least one illumination source for illuminating the GI tract and the interaction chamber;

at least one imager for imaging the GI tract and for imaging the interaction chamber and for producing video signals thereof.

24. A device according to claim 23 further comprising a transmitter for transmitting the video signals.

- 15 25. A device for determining in situ GI tract conditions, the device comprising

at least one interaction chamber for containing a sample from the GI tract environment, said interaction chamber comprising at least one indicator for reacting with the sample for generating optical changes in the interaction chamber;

20 at least one illumination source for illuminating the GI tract and the interaction chamber;

at least one imager for imaging the GI tract and for imaging the interaction chamber.

26. A device according to claim 25 wherein the device is a swallowable capsule.

27. A method for determining in vivo body lumen conditions comprising the steps of:

receiving an endo - luminal sample in an interaction chamber, said interaction chamber having at least one indicator therein for reacting with the endo - luminal sample for generating optical changes in the interaction chamber;

5 illuminating the interaction chamber; and

detecting optical changes occurring in the interaction chamber .

28. A method according to claim 27 wherein at least a portion of the interaction chamber is transparent in the wavelength of illumination.

29. A method according to claim 27 wherein the optical detector is an imager and the step of detecting the optical changes is a step of imaging the interaction chamber.

30. A method according to claim 29 further comprising the step of producing video signals of images of the interaction chamber.

31. A method according to claim 30 further comprising the steps of transmitting the video signals to a receiving system and of receiving the video signals.

15 32. A method for determining in vivo GI tract conditions comprising the steps of:

receiving a sample from the GI tract in an interaction chamber, said interaction chamber having at least one indicator therein for reacting with the sample for generating optical changes in the interaction chamber;

illuminating the interaction chamber; and

20 detecting in vivo optical changes occurring in the interaction chamber .

33. A method according to claim 32 wherein the optical detector is an imager and the step of detecting the optical changes is a step of imaging the interaction chamber and of producing video signals thereof.

34. A method according to claim 33 further comprising the steps of transmitting the video signals to a receiving system and of receiving the video signals.

35. A method for imaging the GI tract and determining in vivo GI tract conditions comprising the steps of:

5 receiving a sample from the GI tract in an interaction chamber, said interaction chamber having at least one indicator therein for reacting with the sample for generating optical changes in the interaction chamber;

illuminating the interaction chamber; and

10 imaging the GI tract and interaction chamber and producing video signals thereof.

36. A method according to claim 35 further comprising the steps of transmitting the video signals to a receiving system and of receiving the video signals.

37. A method for determining in situ GI tract conditions comprising the steps of:

15 receiving a sample from the GI tract in an interaction chamber, said interaction chamber having at least one indicator therein for reacting with the sample for generating optical changes in the interaction chamber;

illuminating the interaction chamber; and

imaging the GI tract and interaction chamber.

20 38. A capsule for imaging the GI tract and for determining in vivo GI tract conditions, comprising

a system, said system comprising

at least one interaction chamber for containing a sample from the GI tract environment, said interaction chamber comprising at least one indicator for

reacting with the sample for generating optical changes in the interaction chamber;

at least one illumination source for illuminating the GI tract and the interaction chamber;

at least one imager for imaging the GI tract and for imaging the interaction chamber and for producing video signals thereof; and a transmitter for transmitting the video signals to a receiving system.

39. The capsule according to claim 38 wherein the capsule comprises two opposing ends and wherein the capsule comprises two interaction chambers and two imagers and wherein the interaction chambers and the imagers are each positioned at an opposing end of the capsule.

40. A transmitter for transmitting video signals, said transmitter operable with a system, said system comprising

at least one interaction chamber for containing a sample from the GI tract environment, said interaction chamber comprising at least one indicator for reacting with the sample for generating optical changes in the interaction chamber;

at least one illumination source for illuminating the body lumen and the interaction chamber;

at least one imager for imaging the body lumen and for imaging the interaction chamber and for producing video signals thereof, said video signals being transmitted by the transmitter.

41. A transmitter according to claim 40 wherein the transmitter transmits the video signals to a receiving system external to the body lumen.

42. A receiving system for receiving video signals, operable with a system, said system comprising

at least one interaction chamber for containing a sample from the GI tract environment, said interaction chamber comprising at least one indicator for reacting with the sample for generating optical changes in the interaction chamber;

at least one illumination source for illuminating the body lumen and the interaction chamber;

at least one imager for imaging the body lumen and for imaging the interaction chamber and for producing video signals thereof; and

at least one transmitter for transmitting the video signals, said video signals being received by the receiving system.

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